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ESTABLISHMENT OF THE CITRUS INDUSTRY IN FIJI.

By H. W. SIMMONDS, F.E.S., Acting Government Entomologist.

There is probably no minor industry in Fiji that offers bigger possibilities to-day than the establishment of a citrus export trade if properly worked, and the following notes partly taken from the official publications of the New South Wales and South African Departments of Agriculture, and partly from local observations may be of assistance in that direction.

Until two years ago the export of this fruit to New Zealand was prohibited owing to the certificate demanded by the authorities of that country being one that it was not possible to give. In consequence of a visit paid by the writer to the Cook Islands the matter was re-opened some two years ago, and New Zealand agreed to admit Fijian citrus fruit subject to its having been held in quarantine for at least seven days in a fly-proof shed, and then repacked under Government supervision. The reason for this quarantine being the presence of a fruit fly (*Dacus passifloræ*) in this country, the attacks of which become visible about a week after the eggs are laid. The attacks are much more easily detected in oranges than in mandarins.

Under this new arrangement several shipments have been forwarded with varying success. These have been principally mandarins which not only are much more difficult to detect when attacked by the fly, but are much more tender and do not stand handling and storing nearly so well as oranges. I am of opinion that oranges will be found to pay in the long run far better than mandarins, and of the latter only the smooth and tight skinned varieties should be allowed to be exported. Oranges are now being shipped in quantity from Australia and South Africa to England and Canada and there is I consider no reason why we should not work up a big trade in these fruits to Canada and New Zealand. Our fruit ripens at a different season and by using early and late varieties can be extended over a long period. Growers however must use only the choicest varieties, and these must be perfectly graded if they are to claim a share of the world's market. To do this however it will be necessary to establish orchards of suitable varieties and to give close personal attention to the work, when few crops yield a bigger profit per acre.

VARIETIES.

Washington Navels if of a good strain are probably the most popular oranges in the world, but strains vary very much in quality. Valencia Late is another first class variety. Jaffa is a fruit which fetches high prices in England. Du Roi is highly spoken of in Africa. The finest orange I have met is a rather pale flat variety of large size and thin skin grown in Tahiti. Efforts are being made to grow this fruit from seed, but if we establish an industry successfully it would pay well to send to that island for wood for grafting purposes.

As citrus trees take from four to five years to come into bearing from grafted stock, it would be a good plan in establishing an orchard to interplant citrus and bananas, so that when the bananas were finished and cut out the citrus trees would be nearly old enough to commence bearing.

Colouring Oranges.

Fijian oranges do not normally take the deep colour of temperate fruit. In New Zealand this is known and whilst a well coloured fruit is always more attractive, there is a market for both. In Canada however colour will probably count for more and the following method taken from *Farmers' Bulletin* , No. 90, Department of Agriculture, New South Wales, may be of interest and is taken from a paper by Mr. L. B. Williams of Whitter, California, read before the California Convention of Californian Fruit Growers:

" Our first sweat-room consisted of a small room, single wall, paper-lined, large enough to accommodate one car of fruit at a time. This room was in the main building; in fact, it constituted the largest per cent. of the main building at that time. The fruit was washed and placed in our picking-boxes, and trucked into this room, stacked ten boxes high, papering the top box.

" When the room was filled, or nearly so, it was heated with kerosene stoves. The first stove was the kerosene drip stove; next we used the ' Perfection B,' also No. 813B, which is the same stove as far as the writer can see. The temperature of the room was held at 90 degrees as near as possible, this being the maximum. The temperature was regulated by the number of burners in the room. It was necessary to keep the fruit moist to keep it from wilting. This was done by evaporation by placing a vessel on the stove and filling it with water, the amount of moisture depending upon the number of burners required for the temperature, so the moisture at this time automatically adjusted iteself.

" If we wished the fruit coloured quickly, this process would continue day and night."

Fruit for export should be cut, with a very short stem and never picked. Snyder's patent fruit clippers are ideal for this purpose as they cut the fruit close without any risk of scratching the rind. Fruit should be placed in bags carried by the pickers from the neck. Pickers should have their finger-nails very closely trimmed so as not to scratch the fruit. Oranges must be graded to size if they are to sell successfully and the number should be stamped on the outside of the case. Mandarins should be packed in shallow trays and not in deep cases. Mandarins should be packed in the trays for the quarantine period to prevent bruising. Oranges should be sunned for three days before going into the sheds.

Oranges will carry best if grown in a region of summer rain with a dry ripening season and such conditions are to be found in many portions of Fiji. Fruit grown in the wetter portions of the Group is not likely to travel nearly so well.

In establishing an orchard with a view to the export of the fruit wind breaks should be carefully established in the direction of the prevailing winds.

Sizes of Packs for Oranges.

The standard pack in Africa and California measures $26'' \times 12'' \times 12''$ outside, the shooks measuring, tops, bottoms, and sides 8 pieces $26'' \times 5\frac{1}{2}'' \times \frac{1}{4}''$ middle and ends, $11\frac{1}{2}'' \times 11\frac{1}{2}'' \times \frac{11}{16}''$. Cleats : $11'' \times \frac{3}{4}'' \times \frac{3}{8}''$. Nine grades are allowed in South Africa, viz.: 96, 112, 126, 150, 176, 200, 216, 252, 280,

to the case and these numbers have to be stamped on the outside. The method of packing such numbers will be shown to anyone interested who calls at the office of the Department of Agriculture.

Diseases.

The worst disease in Fiji is undoubtedly the fruit fly *Dacus passifloræ*. This fly lays its eggs in the rind of the fruit; the eggs hatch and the resulting maggots then bore into the fruit which quickly yellows off. The fly lives in many other fruits the chief of which are kavika, granadilla, and guava and these should not be allowed near a citrus orchard. Further all fruit which is diseased should be collected daily and burnt or boiled. No fruit should be allowed to lie on the ground.

Othreis fultonica.—This is a large moth 4 inches across the wings, the hind pair of which are bright yellow banded with black, the front wings being marked in shades of greenish brown. The moth damages the fruit by piercing the skin and sucking the juices; fermentation then sets up. The attack of this moth can generally be distinguished by the circular soft spot about half inch diameter and its central puncture, whilst in fly attacks the softening is irregular. The larva of this moth feeds upon the Drala (*Erythrina indica*), and these should be carefully destroyed near any citrus orchard. Australia has two fruit flies which attack oranges and also the moth *Othreis fultonica* whilst South Africa has several species of fruit flies, yet both are able to grow citrus fruits successfully and there is no reason why the same should not be done in Fiji provided proper orchards are established and kept clean.

Other diseases are scale insects. One of these, *Chionaspis citri* (?), is fairly common on the undersides of the leaves of oranges and mandarins. The male is a small white scale whilst the female is much larger, brown and of a very elongated shape. It is subject to the attacks of *Chalcid* parasites and seldom gets very bad.

Another species, *Coccus hesperidum*, more abundant on lemons than oranges or mandarins, whilst *Icerya purchasi* is recorded by Veitch and *Aspidiotus aurantii* by Jepson as attacking both oranges and lemons but I myself have not found either on citrus fruit. A mealy bug is not uncommon and is generally attended by a large brown ant. Black aphis is fairly common too, but *Syrphus* flies soon clear the attacks out. The disease known as scab is very bad on lemons, but seldom does any damage to oranges or mandarins. The big black and white butterfly, *Papilio schmaltzi*, occasionally deposits its eggs on lemon, but is very rare and more often uses the *Qiqila* (*Micromelum pubescens* Bl.) as a food plant. The bug *Mictis profana* sometimes damages the young shoots of orange trees and requires picking by hand.

ENTOMOLOGICAL NOTES.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

The following scale insects have been collected by the writer from coconuts in Fiji and identified by the Imperial Bureau of Entomology:—

Aspidiotus destructor, Sign.—Vitilevu, Moturiki, Gau, Ovalau, Kadavu, and Bua.
Aspidiotus cocotis, Newst.—Macuata Island, Koro.
Aspidiotus palmæ, Ckll.—Suva.
Hemichonaspis minor, Mask.—Suva (general).
Coccus hesperidum, L.—Suva (also on lemon).
Pseudococcus cocotis.—Suva.

Hypolimnas bolina.—This butterfly in Fiji feeds upon *Sida retusa*, L. and *Synedrella nodiflora*, Gaertn. (Kindly identified for me by Mr. Greenwood of the Colonial Sugar Refining Company who also identified the *Qiqila* mentioned elsewhere.)

Gelechia gossypiella (Pink Bollworm of Cotton).—Seed pods of vau (*Hibiscus tileaceus*) sent to this office by Mr. Rivington, Inspector of Plantations at Ba, were found to contain larvæ of this moth; this food plant is a new record for *Gelechia gossypiella*.

Cotton,

Since the last issue the following insects from Fiji have been kindly identified for the Department by the Imperial Bureau of Entomology:—

Noctuidæ.—*Anomis flava*, larva green probably feeds on cotton leaves. Pupæ found in ripe open cotton boll.

Lavernidæ.—*Pyroderces euryspora*, Meyr. (nov. sp.) From ripe cotton bolls, probably a rubbish feeder.

Tineidæ.—*Hieroxestis aurisquamosa*, Butl. Also probably a rubbish feeder from ripe cotton bolls.

Coccidæ.—*Saissetia nigra*, Nietn. A large dark coloured scale not uncommon on cotton.

Of the above the last is the only one of any economic importance at present in Fiji.

SPREAD OF LEVUANA IRIDESCENS.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

In Vol. 2, No. 4 of the *Agricultural Circular* an effort was made to trace if possible the early history of *Levuana iridescens* the purple coconut moth in Fiji.

The earliest definite reference to the pest was shown to have been made by Horne in 1878, who found it then ravaging the Rewa and Suva districts. Seemann mentions the poor appearance of the coconuts at Viwa and Bau and attributed it to the soil. There is a possibility that this might have been an earlier reference to *L. iridescens*, but other causes could have also brought about this effect. I am informed by Mr. Kennedy that the disease first appeared at Ba in 1880. Some five years ago it broke out on Malolo where it reduced the yield to practically nil. The Buli Malolo informed

me that when he was a boy, *i.e.*, about thirty years ago, there was a bad outbreak of a disease on the island which might have been the same, but which died out again. *L. iridescens* is subject to an epidemic disease which often destroys it in certain localities and may have done so in this case.

As the disease had been known in Vitilevu for at least forty-five years and except Malolo had not been known to have occurred anywhere else in the group, or elsewhere, and further was not subject to any parasitic, and but few predatory enemies, there was some suspicion that it might be an introduced species which was so scarce in its original habitat as to have escaped observation. Against this has been suggested that coconuts were not planted up by the natives so thickly on Vitilevu as on the other islands of the group. This however seems to me more an effect of the disease than to have been an original condition of affairs, since in forty-five years a considerable proportion of the older trees will die, whilst the disease kills others, and these would not have been replaced in Vitilevu after the outbreak of the pest, as in other islands.

Extension of Range of Disease.

The disease has now extended its range to some of the islands forming the Ovalau Group. When passing the island of Caqalai on the " Adi Keva " recently I observed that the coconuts looked as if a fire had passed through them and I at once suspected *L. iridescens*, and on arrival in Suva found the lessee had mentioned the matter to the local press. I therefore asked him to forward specimens of the diseased leaves, and this he did, when it proved to be *L. iridescens* as suspected. Search was therefore made through the group and the moth was found at two places on Moturiki also. Immediate steps were taken to deal with it.

With the spread of this disease to the Ovalau Group the whole of the coconut districts of Fiji are seriously menaced and I consider most drastic steps should be taken to drive the moth back on to the mainland. Whilst this will be difficult I do not think it absolutely impossible as *L. iridescens* has a habit of first attacking one tree, and seldom goes to the adjoining ones until it has destroyed the foliage of the first, when an attack is usually commenced on several of the surrounding ones.

Spraying with an arsenical spray, and wholesale cutting out and burning are necessary, if we are to cope with it. This will cost money, but if successful will be amply repaid. With this object in view I consider the following recommendations should be given effect to.

Recommendations.

1. The purchase of a portable power spraying outfit with a very long hose.

2. Destruction of all the old very tall trees on Moturiki and spraying of all in neighbourhood of outbreaks until it disappears.

3. Destruction of all palms from Laucala Point to Ellington.

NOTICES.

COCONUT DISEASE (LEVUANA IRIDESCENS).

The disease *Levuana iridescens* prevents the cultivation of coconuts on a commercial scale in Vitilevu. In view of the spread of this disease to the islands of Moturiki and Caqalai and the danger of it spreading to other portions of the group, coconut planters and others are requested to immediately call the attention of the Department of Agriculture to any suspicious disease of coconuts, areca, royal or sago palms which may appear in any district outside the Island of Vitilevu. Portions of affected leaves should be posted to the Department for identification of the disease.

Appearance of Diseased Trees.

Trees attacked by this disease have a brown appearance when seen from the distance, a closer view shows the browning to be as a rule greater towards the tips of the leaflets than at the bases. On examination the leaflets are found to be eaten away in straight lines from the underside. This is done by the larva of a small moth.

Description of Disease.

The moth which causes the disease is dark purple in colour, abour three-eighth inch long when settled, and flies in the sunshine. Its eggs are laid in clusters and are very abundant on the undersides of the leaves where the moth occurs. The eggs are whitish when first laid and turn pink when nearly ready to hatch.

The grub is whitish with a few blackish markings and is very slug-like in appearance. When full grown it is about half inch long and generally crawls to the base of the leaf where it spins a conspicuous white cocoon and pupates, thence turning into a moth and completing its cycle.

H. B. LEES,

Suva, 19th December, 1922. Acting Superintendent of Agriculture.

LEGISLATION WITH REGARD TO COTTON.

It is hereby notified, for general information, that in accordance with Regulation 14 of the Regulations made by the Governor in Council in pursuance of section six of the Diseases of Plants Ordinance 1913, His Excellency the Governor defines the following area in which the disease of pink bollworm of cotton (*Gelechia gossypiella*) exists:—The islands of Vitilevu and Vanualevu (see *Royal Gazette*, No. 47 of 1922, p. 236. The previous notice at p. 222 of the *Royal Gazette* 1922, is cancelled).

It is also notified that His Excellency the Governor declares, in accordance with Regulation 13 of the Regulations made by the Governor in Council on 29th November, 1913, in pursuance of section six of the Diseases of Plants Ordinance 1913, that the Regulations shall apply to the following disease:—pink bollworm of cotton (*Gelechia gossypiella*). And that, in accordance with Regulation 20*a* made by the Governor in Council on 30th November, 1921, His Excellency orders that cotton plants affected with

such disease shall be destroyed and disposed of as provided by the said Regulation (see *Royal Gazette*, No. 45 of 1922, p. 222).

Regulation 20*a* referred to above provides that " the Governor may, if he think fit, at the time he declares any disease in accordance with Regulation 13 of these Regulations, order that trees or plants affected with such disease shall be immediately destroyed and disposed of in such manner as shall be directed by the Superintendent of Agriculture or by an Inspector authorised in writing by him for that purpose and if such instructions are not immediately carried out by the owner of such trees or plants, such trees or plants may be destroyed forthwith by such Inspector at the expense of the owner and disposed of in such manner as such Inspector shall think fit." (See *Royal Gazette*, No. 69 of 1921, p. 336.)

A description of the pink bollworm (*Gelechia gossypiella*) will be found in an article by the Acting Government Entomologist in the *Agricultural Circular*, Vol. 3, No. 3, pp. 36–37. In the same article are given descriptions of the other insect pests affecting cotton in Fiji, the chief of which are *Earias fabia*, and cotton stainers. With the object of preventing the spread of these cotton diseases Regulations were made by the Governor in Council in pursuance of section six of the Diseases of Plants Ordinance 1913, on the 22nd September, 1922 (see *Royal Gazette*, No. 45 of 1922, pp. 221–222). These Regulations, which impose a close season for cotton and give power to the Superintendent of Agriculture to fix the date before which all cotton plants shall be uprooted and destroyed by fire and the date before which no cotton seed shall be planted, are as follows:—

1. All cotton plants shall be uprooted and destroyed by fire by the owner or occupier of the land after the cotton has been picked, and no cotton plants shall be allowed to remain in the ground for a second season.

2. The Superintendent of Agriculture may from time to time by notice in the Gazette fix a date or dates prior to which all cotton plants shall be uprooted and destroyed by fire in any district or districts, and all such cotton plants and all okra or ochroe (*Hibiscus esculentus*) plants in such district or districts shall be uprooted and destroyed by fire prior to such date or dates.

3. The Superintendent of Agriculture may from time to time by notice in the Gazette fix a date or dates prior to which no cotton seed shall be planted in any district or districts.

4. Every owner or occupier of any land which contains cotton plants shall register the name and situation of such land, and the approximate area of cotton planted thereon, by notification to the Superintendent of Agriculture through the District Commissioner of the magisterial district in which such land is situate.

5. Any owner or occupier who fails to comply with, or who in any way evades, the provisions of these Regulations, shall be guilty of an offence, and shall be liable on summary conviction to a fine not exceeding twenty-five pounds, or to imprisonment for a term not exceeding six months.

In accordance with Regulation 2 of the above Regulations, 31st October, 1922, was fixed as the date prior to which all cotton plants should be uprooted and destroyed by fire; and in accordance with Regulation 3 of the above Regulations, 1st December, 1922, was the date prior to which no cotton seed should be planted. (See *Royal Gazette*, No. 46 of 1922, p. 232 and No. 48 of 1922, p. 241.)

The necessity of this legislation does not appear to be understood by many; but the object of a close season is obvious when it is remembered that during any crop season there is a great increase in the numbers of pink

bollworms, cut worms, cotton stainers, and all other cotton pests, and if the crop were allowed to remain in the ground until the following year, it would be subject to a largely increased insect attack, and would also serve as a breeding ground for pests, which would attack any newly planted cotton. Under such conditions the yield of cotton would steadily decrease and it would be impossible to increase the area under cotton with any hope of success. By uprooting and burning the cotton plants after the cotton has been picked the insects attacking that cotton are destroyed and the succeeding crop is subject to a much smaller insect attack. A certain number of the cotton pests can live during the close season on other host plants; okra (*Hibiscus esculentus*) is one of these, and therefore it must be uprooted and destroyed at the same time as the cotton. A close season for cotton has been found to be necessary in other cotton growing countries, and the Government of Fiji were advised to enforce a close season in the Colony by the Secretary of State, who forwarded recommendations of the Imperial Commissioner of Agriculture for the West Indies, and by the Empire Cotton Growing Corporation. An interesting summary of similar legislation in other British Colonies is given in the *Bulletin of the Imperial Institute*, Vol. XX, No. 2, 1922, pp. 192–207.

In order to prevent the introduction of more cotton pests into the Colony a Proclamation, No. 10 of 1922, was made on 12th September, 1922, in which " the importation of cotton seed, seed cotton, and ginned cotton is prohibited from the date of this Proclamation and until further notice except under a written permit from the Superintendent of Agriculture." (See *Royal Gazette*, No. 43 of 1922, p. 215.) Section three of the Diseases of Plants Ordinance 1913, provides that " any person who shall introduce into the Colony any trees, plants, fruit, and seed, or any portions thereof in contravention of such prohibition shall be liable on conviction to a penalty not exceeding one hundred pounds or in default of payment to imprisonment for any term not exceeding six months." Section four of the same Ordinance provides that " any such tree, plant, fruit, or seed . . . . . which there is reason to believe has been imported in contravention of such prohibition shall be forthwith destroyed and no action shall lie for such destruction."

IMPORTATION OF HIDES AND SKINS INTO AUSTRALIA.

The attention of exporters of hides and skins to Australia is drawn to an amendment of the Australian Quarantine Regulations. Regulation 118 of the Quarantine Regulations 1917 (Statutory Rules No. 112 of 1917, and No. 120 of 1922) has been amended and now reads as follows:—

" 118. The importation of hides and skins shall be subject to the following conditions:—

* * * * * * * *

" B. From New Zealand, Fiji, and New Caledonia—

" The owner or consignor shall forward with any hide or skin a declaration made before a magistrate to the effect that such hide or skin was not derived from any animal which had suffered from or died from anthrax or similar disease. The declaration shall be indorsed as correct by a Government veterinary surgeon."

The above regulation replaces that printed in the *Agricultural Circular*, Vo. 3, No. 1, p. 11.

BUD-ROT IN TAVEUNI.

In June, 1922, Mr. M. A. Forsyth, Inspector of Plantations, visited Taveuni in order to deal with bud-rot in coconut palms in accordance with the Regulations (see *Agricultural Circular*, Vo.l 3, No. 1, pp. 10–11). Mr. Forsyth made a thorough inspection of the coconut estates in Taveuni, and wrote a very complete report on the results of his work, giving details as to the prevalence of bud-rot, weeds, &c., on each of the estates. The following summary of this report will be of interest.

Bud-rot has unfortunately appeared on plantations throughout the island with more or less severity. As a whole it appears from Mr. Forsyth's observations on the distribution of this disease that the older coconuts growing near the sea-shore are attacked to a very slight extent, but that most of the cases of bud-rot are found amongst the younger coconuts planted some distance from the sea-shore. It is probable that many of these younger coconuts are growing under unfavourable climatic and soil conditions and are for these reasons less able to resist the attacks of this disease than the older healthy trees.

Most of the European planters are fully aware of the danger of bud-rot and have realised the importance of dealing with it promptly. On many estates a great many diseased coconut palms have been destroyed, and active steps are still being taken to deal with this disease. It is to be hoped that a careful watch will be kept for any further signs of this disease, and for reasons given above particular attention should be paid to the younger coconuts in the back areas away from the sea. It is to be regretted that on the native owned estates no steps appeared to have been taken to deal with bud-rot, and the danger of this disease did not appear to have been realised by the owners. With regard to one of these estates Mr. Forsyth stated: "Bud-rot had received no attention on this estate. A number of trees were found in the back area badly affected and numerous headless trunks pointed to the fact that numbers of trees had died."

Mr. Forsyth called attention to the fact that the coconuts "on the whole are very free from disease. Leaf-miner, spathe-borer, and stick-insect are present to a limited extent. Of scale I saw no sign whatever." On the other hand, he refers to the numbers of coconuts which are germinating on the ground and the spread of noxious weeds on many European and native owned estates. The weeds particularly referred to as gaining the ascendancy on many estates are *Clidemia hirta*, Lantana, guava, and "mile-a-minute." It is only right to say that some planters are taking active steps to cope with these weeds, and by offering a reward for every *Clidemia hirta* plant found on their estates are keeping it in check; yet on many estates there is "no evidence of efforts being made or having been made for several years to cope with weeds and undergrowth. They are nurseries for the propogation of noxious weeds and breeding grounds for pests and diseases."

NOOGOORA BURR.

The following report on Noogoora Burr is by Mr. H. V. G. Rivington, Inspector of Plantations.

In reply to your letter No. 616/22 of 6th November on the above subject I beg to report as follows:—

2. Since my first visit to this coast in May, 1920, in connection with Noogoora burr eradication, 28 orders to destroy Noogoora burr have been given, viz.: 4 to Europeans, 21 to Indians, 2 to Fijian Bulis, and 1 to a Chinaman. There have been 9 prosecutions for failure to carry out orders given, viz.: 1 European, 1 Fijian, and 7 Indians. Of these 3 Indians were find £4, £3, and £2, while the remainder of the cases were adjourned *sine die* to allow the offenders another chance to comply with orders.

3. The burr area extends from Natawarau in Ba province to Penang in Ra province. In the Ba district the worst patches occur on the upper Ba River, for the most part in Indian cultivations. Here there has been no marked decrease since 1920. The reasons being: (1) that the burr had already a big hold on the land; (2) that in this part the plant seeds almost as soon as it appears above the ground (*vide* my report of 19th September, 1921); (3) the difficulty of regular supervision during the wet season on account of the flooded state of the river. In all other parts of the Ba district there is a marked decrease in the amount of burr and several places are now altogether free of it.

4. From Tavua on to Yaqara Estate there were formerly a few small patches along the road, evidently carried there by stock, but these have now been successfully dealt with. On Yaqara Estate the burr though not thick in any one place is spread over a wide area on account of being carried about by stock. However the affected areas have been marked down and the manager is dealing with the weed.

5. On land belonging to the Fijians of Drauniivi and Togovere in 1920, there was a good deal of burr brought there by goats from Caboni, but now the land is nearly clear of the burr. This is due to the fact that on my visits of inspection to this district I set the men and women of the two towns to work and stayed with them until the land had been weeded to my satisfaction.

6. On Caboni the European owner, ever since the passing of the Noogoora Burr Ordinance has been very zealous in rooting out the plant with the result that his land is now very nearly free of burr.

7. Up the Waigumu creek, three miles from Vaileka, there was a lot of burr in Indian cultivations but the amount has noticeably decreased during the last two years.

8. At Vaileka there was formerly a small patch of burr on the Government Station but this has been destroyed. Small patches on the Penang Sugar Company's Estate have also been successfully dealt with.

9. Many reported patches of Noogoora burr have been investigated. The wild egg plant is often mistaken for the burr. Inspections of all affected areas from Natawarau to Penang have been carried out on an average once every two months.

10. During the strike of Indians early in 1921, I was attached for duty to Captain Kane, M.C., and so for nearly three months there was no supervi-

sion of burr eradication, with the result that there was a marked increase during this period.

11. In conclusion, I would say that by regular supervision it will be possible to reduce the amount of burr to a minimum except on the upper Ba River.

THE BANANA BORER (COSMOPOLITES SORDIDA).

The banana borer, *Cosmopolites sordida*, one of the most serious problems banana growers have to face, is now widely distributed throughout the tropics. In Fiji it is almost universal and the reduction of yield from this cause must reach a very high percentage. In Queensland it has been the subject of long and careful investigation and the following methods suggested for its control by the Government Entomologist, J. L. Froggatt, are equally applicable to Fiji.

From Queensland Agricultural Journal, October, 1922,
by J. L. Froggatt, B.Sc.

The importance of the banana beetle borer problem in its relation to the continued welfare of the banana growing industry of Queensland is gradually becoming recognised . . . . . .

Control.

The basis for any means of control of the banana beetle borer must rest on keeping the plantation as free as possible from breeding grounds and harbourage (*e.g.*, old corms, butts, and cut stems).

A badly infested stool is only a menace to the remainder of the plantation and should, therefore, be dug out and destroyed. In slightly infested stools, old butts, and infested material should be completely removed and either burnt or chopped up into small pieces, and the stems should be split in halves lengthways. By the opening up of corms and stems in this manner they will dry up or rot rapidly and cease to serve as either breeding grounds or harbourage. Wherever infested material is found, pieces of clean corm should be laid, cut surface downwards, flat on the ground, in or just outside stools or on the spot where infested cut stems, &c., are met with. These will act as baits for the beetles, and should be examined once per day; in the morning is best. The beetles will be found either on the under surface of the bait or just underneath the soil under the bait. They can thus be collected and destroyed. No bait should be used for more than ten to fourteen days, as eggs will be laid in them and they will be thus liable to serve as breeding grounds; these pieces of corms should, therefore, be collected periodically and destroyed and fresh ones put out in their places. This procedure should be continued as long as beetles are caught under these baits. *These measures must be carried out throughly and continuously, however, to be effective.*

In order to guard against the spread of the pest into a new plantation, too much care cannot be exercised (1) in the selection of suckers to be used for planting, to ensure that they are free from any risk of being infested by the pest; and (2) in ascertaining that the site for the plantation is not adjacent to a beetle borer infested area.

Suckers may be dug in an infested plantation and be free from beetle borer when removed from the stool, but lying on the ground, often overnight, they act for the time being as baits. Beetles attracted to them deposit eggs which are extremely difficult to detect, resulting in infested suckers being planted. Any which die off after planting should be dug out and closely examined for signs of beetle borer, evidenced by grubs or their tunnels, and possibly by beetles themselves.

Old butts, sometimes used for planting, are more readily examined than suckers for the presence of beetle borer, as the larval tunnels at least should be readily seen when the butt is opened up.

Plantations laid out adjacent to beetle borer infested areas are very liable to become infested on account of the beetles migrating from the old into the new area, particularly as the food supply in the former become exhausted. Corm baits should be laid around the edge of the infested area and carefully examined periodically, and wherever practicable it is advisable for the growers' own benefit to dig out and destroy the infested stools whenever opportunity offers.

The presence of beetle borer in a mature plantation is most readily detected at any stage beyond that of the egg, by the presence of larval tunnels in old corms and stems; often the grubs and beetles will be found. Suckers showing an unhealthy appearance should be dug out and examined for signs of infestation.

Preliminary tests have just been started to ascertain if any method can be obtained which will be applicable to field conditions to free infested stools of the pest and prevent any reinfestation, and to prevent clean stools from becoming infested through the medium of treatment of the soil. These tests are in far too elementary a stage to warrant any comment on them at present.—*Queensland Agricultural Journal.*

THE PINEAPPLE INDUSTRY IN HAWAII.

(*Extract from the "Honolulu Advertiser" of 20th September*, 1922.)

Pineapples are much in the public eye here and abroad. Ten million cases of this luscious fruit could have been sold this year as readily as the actual crop of half that total. There is every prospect that Hawaii will have a ten-million case pack in 1925 and that by that time the demand will be for fifteen or twenty million cases.

The rapid rise of the pineapple business has already brought vital change in the industrial status. This crop has made the semi-arid uplands more valuable than unirrigated cane lands.

It has injected a new crop between the cane lands and the edge of the forest and there have already been brushes between the cane planters who want the reserves extended, and the pineapple men who are not particularly interested in forest extension because their particular crop does not depend on irrigation.

The pineapple industry is fully as profitable as the sugar industry, comparing the capital invested, dollar for dollar. It needs labour and has made heavy inroads on the supply available for cane cultivation. Pineapples

grow on the cool uplands where men can work in greater physical comfort. Hence, when there are not enough men to go round, the cane planters usually suffer.

The pineapple industry is making Honolulu over into a factory city, with all the problems which go with the increase of population in manufacturing cities. It is also building up a new coterie of millionaires.

Another generation will see large areas now unprofitably cropped in cane transformed into pineapple plantations, but there is no indication that the same lapse of time may not also see a material increase in total sugar tonnage. The cane planters will make better use of their richer lands. They will use brains as fertiliser and double their yields through intensive agricultural practice.

We predict a $100,000,000 annual pineapple crop and a $100,000,000 annual sugar crop in another twenty years, with a good many other commercial crops doing their share towards the general prosperity of Hawaii.

Note by the Editor.—In 1903 the output of canned pineapples from the Hawaiian Islands was 1,893 cases; in 1912 it was 1,313,363; in 1920 and 1921 about 6,000,000 cases were packed; and an output of 10,000,000 cases is anticipated in 1925, by which time it is estimated by a good authority that the world's demand will be for 15,000,000 to 20,000,000 cases.

ACTUAL AND AVERAGE RAINFALL FOR THE MONTHS JULY—NOVEMBER, 1922.

Province.	Station.	Observer.	No. of years.	July.		August.		September.		October.		November.	
				Actual.	Average	Actual.	Average	Actual.	Average	Actual.	Average	Actual.	Average
				"	"	"	"	"	"	"	"	"	"
Ba	Narovurovu	District Commr.	..	1·00	..	6·75	..	13·25	..	6·75	..	14·70	..
Ba	Navisa	C.S.R. Coy. Ltd.	15	1·07	1·32	6·32	4·12	9·77	2·55	5·65	3·76	11·44	6·10
Ba	Rarawai	C.S.R. Coy. Ltd.	28	1·27	1·60	5·90	3·30	7·79	2·30	4·57	3·19	10·01	4·71
Bua	Baulailai	F. W. Whittstock	17	2·20	2·12	1·90	2·34	7·50	3·01	10·50	3·67	7·50	6·05
Bua	Nabouwalu	Roko Tui Bua	5	2·70	3·74	7·14	4·72	5·53	4·92	15·98	6·42	17·14	8·88
Bua	Wainunu	S. E. Martin	43	1·25	5·63	8·35	6·83	7·75	9·29	11·40	10·88	12·85	11·95
Cakaudrove	Buca Bay	W. C. Fisher	10	4·07	3·22	nil	3·92	3·68	4·03	4·20	4·95	13·26	8·42
Cakaudrove	Rabi	W. P. Lyons	18	3·29	4·58	4·76	7·00	3·29	8·00	7·16	9·30	14·90	11·21
Cakaudrove	Savusavu Bay	Wireless Officer	16	1·65	4·44	11·35	6·22	8·58	7·15	6·11	7·88	7·10	8·09
Cakaudrove	Salialevu, Taveuni	W. T. Peckham	..	6·23	..	8·78	..	11·19	..	5·85	..	18·29	..
Cakaudrove	Vuna, Taveuni	Tarte Bros.	3	3·26	5·00	11·36	7·67	5·81	9·95	8·92	12·36	2·74	6·81
Cakaudrove	Waiyevo, Taveuni	Wireless Officer	16	1·28	2·33	1·85	3·46	1·57	5·22	7·47	7·81	6·11	8·83
Colo East	Vunidawa	District Commr.	10	4·57	5·38	9·22	7·25	20·20	9·75	12·10	8·93	17·00	12·49
Colo North	Nadarivatu	District Commr.	22	3·80	3·11	6·35	5·71	10·88	3·98	4·66	4·53	9·03	8·11
Colo North	Tavua	C.S.R. Coy. Ltd.	16	1·58	1·22	4·41	3·16	11·05	2·02	4·20	2·49	6·62	4·26
Lau	Munia	H. H. Steinmetz	27	1·49	2·76	2·50	3·62	2·35	3·37	3·11	4·98	2·24	5·68
Lau	Nabavatu	Hennings & Allardyce	3	1·79	3·10	2·36	1·98	3·12	4·41	4·95	4·71	2·93	3·54
Lautoka	Lautoka	C.S.R. Coy. Ltd.	22	·85	1·83	6·61	3·81	7·92	1·96	5·95	3·16	12·27	3·93
Lomaiviti	Levuka	Harbour Master	28	3·20	3·63	4·75	5·75	5·73	5·10	5·34	5 46	11 34	8 36
Lomaiviti	Makogai	Res. Med. Supt.	11	2·85	4·96	3·83	3·53	3·29	6·11	4·14	3·99	6·92	4·47
Macuata	Labasa	C.S.R. Coy. Ltd.	28	1·07	1·89	1·26	1·74	1·23	2·64	3·50	3·23	7·90	5·20
Nadi	Navo No. 2	C.S.R. Coy. Ltd.	21	2·38	1·91	10·69	3·86	6·83	2·08	5·46	2·78	7·69	3·71
Nadroga	Lawaqa	District Commr.	16	3·56	2·44	10·58	6·04	8·68	2·83	4·57	3·90	*	..
Ra	Rakiraki	Penang Sugar Coy.	38	2·77	1·89	4·16	3·22	8·76	2·43	5·92	3·38	9·42	5·48
Rewa	Suva	Supt. of Agric.	38	3·79	4·71	10·55	7·37	12·67	8·16	8·37	7·92	13·23	9·88
Serua	Naitonitoni	District Commr.	6	2·67	6·86	10·81	9·60	9·09	8·77	6·68	8·93	21·29	14·98
Serua	Tamunua	V.-F. Sugar Coy.	38	2·54	5·80	10·54	9·84	10·34	8·97	9·44	10·87	*	..
Tailevu	Nausori	C.S.R. Coy. Ltd.	28	2·68	4·40	8·08	6·72	11·54	6·53	14·13	7·49	13·38	9·09
Tailevu	Yaralla	Lord & Nichol	..	3·88	..	8·39	..	21·09	..	18·94	..	26·88	..
Rotuma	Rotuma	Resident Commr.	18	3·46	6·84	7·73	9·10	8·55	9·59	12·44	9·48	18·67	12·37

* Rainfall return not received.

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